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## 6 **Reconcilability of Socio-Economic Development** 7 **and Environmental Conservation in Sub-Saharan Africa**

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11

### 12 **Abstract**

13 Are the achievements of sustainable development and the improvement of environmental  
14 standards mutually exclusive in the 21<sup>st</sup> century? Is there a possibility to combine the two?  
15 This study is an effort to investigate the mutual exclusiveness of the two policy areas and  
16 asks for the necessity and possibility to combine the two with a reference to Sub-Saharan  
17 Africa (SSA). After describing the historical, geographical, and climatic backgrounds of  
18 SSA, negative effects of global warming and local environmentally harmful practices are  
19 discussed. Subsequently, the appropriate development measures for the region are  
20 elaborated on in order to understand their compatibility with regards to improving the  
21 environment. It is concluded that to change the dependency on agriculture, the economy  
22 needs to be restructured towards technologies. Furthermore, it is found that there is a direct  
23 link between global warming and economic efficiency. Theories, which imply that some  
24 regions are simply ‘too poor to be green’, are investigated and rebutted by another theory,  
25 which states that it is indeed possible to industrialize in an environmentally friendly way. It  
26 follows that environmental and development measures are interconnected, equally  
27 important and can be reconciled. The paper finally concludes that the threat posed by

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28 global warming and the previously practised environmentally-harmful local measures  
29 might be so pressing that it might be too tragic to go for ‘develop first and clean up later’  
30 approach.

31

32 **Keywords:** Climate change, global warming, pollution, sustainable development,  
33 development measurements, environmental measurement.

34

### 35 **1. Introduction**

36 The region of SSA, is one of the poorest areas in the world due to, amongst other reasons,  
37 economic mismanagement, post-colonial struggles, the spread of infectious diseases  
38 (especially HIV/AIDS), inter-ethnic conflicts, desertification, and water shortages.  
39 However, in the 21<sup>st</sup> century, global warming is also increasingly affecting SSA, as the  
40 region, which is heavily reliant on the export of agricultural products, has more and more  
41 been threatened by rising desertification. It is proven that there is a direct link between  
42 global warming and poverty in SSA and that it will become even more difficult for the  
43 region to increase economic growth and sustainable development in the future due to the  
44 devastating effects of the climate change (UNEP, 2002, p. 29).

45 “Warmer temperatures and altered rainfall patterns could open up new areas to  
46 diseases such as malaria, yellow fever, dengue fever and trypanosomiasis (IPCC,  
47 1998)”.  
48

48

49 Thus, measures combating climate change and local environmentally harmful practices  
50 have become more important for sustainable development in SSA. In line with the  
51 principle of equity for instance, the share of global emissions originating in the SSA  
52 countries will need to grow in order to meet their social and development needs if,

53 according to the Kyoto Protocol (UNFCCC, 2008), the countries should share the common  
54 responsibility of all countries in reducing emissions. This could mean that they are allowed  
55 to increase both their productions and pollution. Consequently, for their agricultural system  
56 for instance, farmers will continue their conventional farming systems that encourages the  
57 use of chemical fertilizers and pesticides while they need to consider other (sustainable)  
58 agricultural approaches (Azadi and Ho, 2010; Azadi et al., 2011a,b) based on their local  
59 measurements (Bazuin et al., 2011) as well.

60 Accordingly, the question of the reconcilability of anti-global warming measures, local  
61 environmental protection measures, and development policies arises. Earlier, literature  
62 introduced the theory of Grossman and Krueger (1991) who applied the Environmental  
63 Kuznets Curve (EKC) which implies that “low income regions are ‘too poor to be green’”.

64 According to the EKC, while high-income countries will naturally reduce pollution as they  
65 become richer, low-income countries are neither capable of reducing pollution nor of  
66 developing economically in an environmentally friendly way (Bertinelli et al., 2005, p. 2).

67 Unlike this theory, in this paper, a new premise will be investigated. The premise questions  
68 a deduction from the EKC, asking whether pollution is directly connected to income.

69 Moreover, the question whether environmental measures that aim to challenge with the  
70 problem of global climate change, remains on Sub-Saharan Africa’s responsibility, is

71 addressed. More precisely, the following thesis will be discussed. Investing resources into  
72 environmental improvement would automatically mean that few resources will be invested

73 in socio-economic development. Thus, protecting the environment may retard the process  
74 of developing in regions like SSA. Therefore, a focus on environmental protection is only

75 possible when the region is more developed. To investigate the thesis, the following  
76 questions will be answered. Are the achievement of sustainable development and the

77 improvement of environmental standards mutually exclusive in the 21<sup>st</sup> century? Is there a  
78 possibility to combine the two?

79 Before starting our main arguments, it should be mentioned that reconcilability has a lot  
80 more to do with socio-economic development than the structural changes of economy,  
81 incentives to invest in and the development of technologies, because the environmental  
82 measures have more to do with the socio-economic development than simply stopping  
83 (e.g.) deforestation and over-exploiting or switching in renewable energies and more  
84 efficient technologies. However, a narrower scientific analysis in which only a few specific  
85 development strategies are investigated as their ability to be transformed into more  
86 environmentally friendly strategies would provide a more complex analysis of the issue.

87

## 88 **2. Reasons for and characteristics of Sub-Saharan Africa's underdevelopment**

89 While today, Sub-Saharan Africa contains the poorest countries of the World (50% of its  
90 population live on less than a Dollar a day), (Canada International Development Agency,  
91 2008), before colonialism, most societies resembled nation-states with tribes of the same  
92 ethnicity living in self-sufficient communities independent from each other:

93 “...organized around kith and kin, with authority exercised through a system of  
94 chieftaincy, clan elders, and heads of households. Given the mainly autarchic way  
95 of life of most people, this was generally adequate to meet most welfare  
96 requirements — from housing and the storage of food to personal support in times  
97 of bereavement — based on accepted reciprocity and equitable personal intimacies”  
98 (Osei-Hwedie and Bar-on, 2007).

99

100 The Colonial powers subjected cultural and all socio-economic and political activities to  
101 their interests; Africans were to be physical workers. Thus, the Western type of education,

health, and related social services were restricted to “upper” classes of the population. In other words, Colonialism is one of the reasons why countries in Africa became structurally dependent on the Western Powers and did not develop at the same speed (Osei-Hwedie and Bar-on, 2007). Dos Santos’ statement about the dependency-theory explains the situation quite well:

“[Dependency is]...a historical condition which shapes a certain structure of the world economy such that it favours some countries to the detriment of others and limits the development possibilities of the subordinate economics...a situation in which the economy of a certain group of countries is conditioned by the development and expansion of another economy, to which their own is subjected.”  
(Dos Santos, 1971, p. 2 )

Largely colonized by Great Britain, France and Portugal, the states of Sub-Saharan Africa slowly started regaining independence after the Second World War and the whole continent was decolonized by 1980. However, the boundaries were drawn in 1884 by the state-officials of the colonial powers regardless of cultural and ethnic groups or tribes.

“Africa’s boundaries were, for the most part, arrived at with no reference at all to the social or cultural characteristics of the people they partitioned...An indication of their disregard for the populations they bisect comes from Asiwaju’s (1985) estimate that Africa’s 104 distinct borders divide 177 cultural or ethnic groups.”  
(Posner, 2006, p. 2)

The arbitrariness of the “border-decisions” led to struggles connected to self-determination and racial discriminative attitudes in the region. In some states of SSA, a complete collapse of the state and subsequent collapse of institutions and socio-economic development

policies has occurred. Examples are Somalia or Congo where civil wars were caused by ethnic conflicts (van de Walle and Ball, 2003, p. 1). However, even the politically most stable countries of the region do not appear to be capable of implementing policies that aim at enhancing the structural transformation of the economy. States are characterized by low absorption capacity, fiscal crisis and corruption (UNIDO, 2004, p. 45). The whole region is dependent on natural resources, high levels of poverty and weak infrastructure. As bluntly stated by Michael Glanz:

“Sub-Saharan Africa is plagued by innumerable problems related to population growth rates, resource depletion, environmental degradation, bleak food-production prospects, heavy international debt, little or no foreign exchange and an uncertain climate, not only the climate of the future (e.g. climate change) but the climate of today (e.g. climate variability)” (Glanz, 1992).

The exogenous factors, which influence SSA’s development, are unfortunate as nearly 40 percent of the region’s population is land-locked without significant natural resource endowments (UNIDO, 2004, p. 20). Moreover, the amounts of rain and its distribution are highly unpredictable, especially in Western and Central Africa. These areas suffer from chronic droughts, crop failure and a subsequent rise in food prices. Ironically, East Africa has been struck by record rainfalls, which led to disastrous flooding and internally displaced persons. Therefore, the rapid change of the climate might be assumed as an obstacle for development, inter alia because the rise in temperature has caused the agricultural sector to stagnate. The theory by Bloom and Sachs (1998) could support the argument that the region is poor due to its natural circumstances and endowments should not be disregarded. It emphasizes that it might be difficult to achieve economic growth with a lower coastal-land ratio, a higher proportion of land in the tropics and high latitudes,

152 all of which are criteria applicable to the region. However, there are many other factors,  
153 mainly “assimilation policy”, “indirect rule”, and “slave trade” that led to the  
154 underdevelopment of the region as briefly explained below.

155

156

## 2.1. *Assimilation policy*

Assimilation policy is originated from the surviving fragments of the first French empire during the Revolution of 1789. The theory behind the policy could be traced to Nicolas de Condorcet's (1743-1794) famous phrase: "a good law is good for all men, just as a sound logical proposition is sound everywhere" (Lewis, 1962, p. 134). Accordingly, the French assimilation concept was first based on the idea of expanding French culture to the colonies outside of France between the 19<sup>th</sup> and 20<sup>th</sup> centuries through attempting to turn Africans into the French civil norms. Consequently, the French language was intentionally teaching at schools and churches, along with the French history and other cultural aspects of the country. As a result, the colonies were considered French citizens as long as the French culture and customs could be adopted. This also meant they would have the rights and duties of the French citizens.

As soon as the 19<sup>th</sup> century drew to an end, the criticism of assimilation became harsher (Ginio, 2006). The meaning of assimilation was increasingly criticized, mainly because it was based on the superiority of French culture and civilization. The (French) laws were applying to all colonies regardless of all dissimilarities (Van Den Berghe, 1962). As a result, little attention was paid to the political, social, and economic development of the colonial countries. African societies were presumed to have no history or civilization, largely in a state of war and flux. Africans were basically the subjects of France, not citizens, and had no political rights or the rights of representation. However, there was also a growing recognition that Africans had a very different culture.

## 2.2. *Indirect rule*

Indirect rule was a governmental system developed in certain British colonial dependencies, dominantly in parts of Africa and Asia. Due to this system, much of the



182 habitual government of localities was left in the hands of local rulers who have gained their  
183 prestige and stability traditionally (even if at the cost of a loss of autonomy). The system  
184 thus allowed a limited number of European colonial administrators (mostly British) to  
185 effectively manage the government of great numbers of inhabitants spread over large areas  
186 (Olson, 2002).

187 While indirect rule was cheaper and easier for colonial authorities, and in practice, it  
188 needed fewer administrators; it made a number of problems. In many cases, the authorities  
189 significantly empowered local leaders. This is especially true in the case of the monarchy  
190 of Uganda. On the other hand, if no workable authority upon, to the Western definition,  
191 was available, the colonizers would simply decide on their own local administrative  
192 officers who might not always be supported by the laypeople. The officers were often  
193 selecting those local leaders who held the most similarities to them than to native leaders.  
194 Moreover, most officers were conservative that was opening a narrow outlook to the  
195 public, more especially to marginal people like women and young generation. Unwritten  
196 oral laws were replaced by officially legalized laws which were less flexible to the people  
197 and traditional customs. Consequently, the customs and old justice had no function  
198 anymore while the society was neither prepared to go for the new rules. Additionally, the  
199 new empowered leaders by the colonial governments were often not familiar with their  
200 new tasks (such as recruitment and tax) either. As a result, an increase in crime and  
201 violation happened (Collins and Burns, 2007).

202 Many authors (Boone, 1994; Mamdani, 1996; Migdal, 1988) have already showed how the  
203 institutional legacies of the indirect rules created ineffective central administrations and  
204 empowered non-skilled local officers, and thereby launched a system of decentralized  
205 autocracy that has made the state too ineffective to nearly be collapsed (Lange, 2004).

### 2.3. *Slave trade*

The dispute about the role of the slave trade economy has led to a controversy in both academics and non-academic world on whether the trade has brought up SSA with negative or positive outcomes impacts (Orji, 2008).

From the historically point of view, slavery has had an important role in the SSA's underdevelopment because it has not only promoted ethnic fractionalisation but also destabilized effective states. A shoddier fact is that the most slaves were exploited from the most politically underdeveloped regions that are still the most ethnically fragmented today. According to Nunn (2008) without the slave trade, 72% of Africa's income gap with the rest of the world would not exist today. Accordingly, he considers a negative causality between slave trade and the current economic status in Africa. He discusses that the slave trade has prevented the development of the states, increased ethnic fractionalisation and declined legal institutions which have significantly postponed the economic development of the region (Kumo, 2009).

Due to some African historians (Gemery and Hogendorn 1979; Inikori 1992; Manning 1981), the vulnerable effects of the slave trade are laid on the institutions and structures of African societies. The historical evidence of their case studies explains how the slave trade has induced politically instable and socially unable states. It has also led to socio-political fragmentation, and resulted in a corrosion of local institutions. Upon to this vision, Africa's engagement in the slave trade should be understood as one of the main causes of massive depopulation in the continent. Bhattacharyya (2007, p. 2) further regards it as a cause to an implosion of the continent's production possibility frontier and an unambiguous reduction in welfare. He believes that the secular decline in welfare continued even over more than two centuries that has halted the continent with an economic backwardness.

Despite the above historical and exogenous factors, and although the factors cannot be changed, many other factors that are disadvantageous for SSA can. Furthermore, if one looks at the region as a whole, the natural factor endowments are not outstandingly unfortunate as low population density is typical for the region and therefore, per capita natural resource endowment ratio is rather favourable. Moreover, the region owns valuable resources such as gold and diamonds in Sierra Leone and oil in Nigeria (Smilie et al., 2000 p. 17). Hence, a challenge for the region is to transform resources into income without enlarging inequalities (Holmberg, 2007, p. 27). Yet, the extreme climate as an obstacle to socio-economic development should not be disregarded.

### **3. Essential measures for the enhancement of socio-economic development in Sub-Saharan Africa**

When it comes to development measures and policies, many different theories exist as to from which angle development strategies should be approached. There is no guarantee for the “perfect strategy” as development is such a multifaceted process (Azadi et al., 2011c) and regions such as SSA are complex and being influenced and shaped by many different factors. Contrary to the global trend of large companies shifting production to developing countries (which have cheap labour) and therewith enhancing their development, SSA has not had an increase in manufacturing (King, 2010), due to a widening productivity gap, between agriculture and manufacturing and between manufacturing and economy-wide productivity (UNIDO, 2004, p. 40). Thus, industrialization needs to happen in the following way:

“Declining farm sector employment is offset by technological advances that raise productivity in agriculture, while the demand for services grows in the transaction-intensive manufacturing sector.”(UNIDO, 2004, p. 47)

The following sections explain how this should happen.

### *3.1. Necessary changes in the economic structure*

According to the United Nations Industrial Development Organization (UNIDO, 2004, p. 33), in order to attain a higher level of economic growth in SSA, the growth must undergo three phases of structural change, namely a demographic transition, a structural change in agriculture, and a compositional change within manufacturing. The demographic transition brought about by a reduction in the fertility rate would:

“...reduce the denominator in the income per capita indicator while releasing resources for investment in human capital, with the net effect of raising human capital per capita.”(UNIDO, 2004, p. 33).

The fewer children women have, the less unpaid (house) work they undertake, and the more human capital will be released, as women have time to contribute to the economy. A lower dependency ratio would lead to more productivity in the economy (Szmirai, 2005, p. 150). Ultimately, the output of the economy will increase with the number of available workers and the efficiency. Secondly, to boost the economic growth, an increase of productivity in the agricultural sector needs to happen in order to increase output and free labour and resources for the establishment of an industrial sector. This generally happens through irrigation, the use of fertilizers and chemicals as well as improved seeds, mechanization and the enhanced rural infrastructure. As income through agriculture grows, demand for goods (besides food) rises that gives an impulse for the development of the manufacturing sector (Boserup, 2005; Diao et al., 2007). Finally, to enable the manufacturing sector to absorb the surplus labour from the agricultural sector, some reforms are required. Accordingly, a shift to produce more capital- and skills-intensive activities is necessary. This could, for example, be a change from

producing textiles to industrial machineries or chemicals. To facilitate this change, some improvements in human skills as well as the capacity to exploit advanced technologies are needed. Supremely, as the manufacturing sector evolves, a service-sector originates. As already mentioned, a large part of the population of SSA is land-locked which makes those parts reliant on the export of regionally tradable goods (Ehui and Pender, 2005). Accordingly, those regions are dependent upon the growth of purchasing power in the rest of the region (Ndulu, 2006). Thus, development strategies need to address more than one state, and regional integration needs to be a key factor of the development measures. Ideally, the land-locked countries will be exporting food and services to their neighbours, which in turn trade manufactured good and resources on the international market (UNIDO, 2004, p. 20). In the coastal regions, it is important to become globally competitive in manufactures by using the “central” location and lower per capita incomes as a comparative advantage in comparison to, for instance, Asia.

### *3.2. How to achieve a demographic transition*

It is often argued, that women in SSA have many children, due to their religious belief and cultural traditions (Teller, 2009). However, according to the theory of “demographic transition”, a reduction in fertility rate usually happens as soon as income-levels rise without a conversion to a different faith (Smirzai, 2005, p. 146). Child-mortality decreases as soon as wealth is accumulated and health systems as well as social security system improve. Especially in rural areas, children function as a guarantee for future, as they will be able to work and feed their parents once they are old. As soon as parents know that the child-mortality is low, fertility rate usually decreases. Secondly, if there was a public system of social security that could look after the parents in their elderly age, fertility rates would decrease as well. However, in this situation, a reduction of the fertility rate should be achieved

not due to economic growth, but rather as a prerequisite for economic growth. Thus, if foreign direct investments could assist in building up social security systems and health care, as long as states are not able to deal with it without external help, the fertility rate would start decreasing and then lead to self-sustained development.

Furthermore, other factors like HIV/AIDS, sanitation, road accidents, wars and insecurity are important determinants to achieve a successful demographic transition in the region. According to Andoh et al.'s (2006, p. 630) findings, the HIV/AIDS infection rate is significantly associated with adult mortalities and lower life expectancy, but negatively associated with infant and maternal mortality rate. This is because the adult population is at risk of HIV/AIDS infection, as sexual relations are the main mode of transmission in SSA. Their findings need to be interpreted in the context of an association between HIV/AIDS and education. In another analysis by Walker et al. (2002), a positive association was found between infection rate of HIV/AIDS and education. Moreover, throughout the region, dramatic improvements could be emerged largely from the improved sanitation and safer water. According to Bloom and Canning (2000), decreased infant and child mortality, combined with the increased life expectancy and finally a fall in fertility could be brought about by improved sanitations. Both HIV/AIDS and sanitation have already been targeted by the MDGs (see: <http://www.un.org/millenniumgoals/>). Developing safer sanitation system has already been launched by Professor Muhammad Yunus when developing the Grameen Bank (see: <http://www.grameen.com/>).

Yet, to achieve a feasible demographic transition, road accidents should also be addressed. In SSA, such accidents are one of the main classes involved in fatal accidents (Jacobs and Aeron-Thomas, 2000) that have resulted from unsafe roads (Elvik et al., 2009) contributing significantly to the demographic transition. Lastly, wars and insecurity have been traditionally (Omran, 1971) understood as the two main causes of demographical change worldwide

(Cleland et al., 1994; Lee, 2003), and more recently in the Horn of Africa where the region suffers much from social conflicts (Tareke, 2009) that has worsened food insecurity in the region (Azadi et al., 2011b; Bazuin et al., 2011).

### *3.3. How to stimulate agricultural development*

The urban biases from governments, which are perceivable in parts of SSA and have led to massive waves of immigration to urban centres, need to be transformed into recognition of the agricultural sector's importance:

“Where government policy discourages agricultural production and encourages agricultural imports to supply urban needs, there will be no positive impact of urbanization on agriculture” (Cleaver, 1993, p. 89).

Politicians exert pressure on farmers to keep food prices low (Koning, 2002; Ashby, 2003). Moreover, the urban bias exacerbates the marginalization of women and elderly people in rural areas while young men should work in urban centres. Thus, women, who also need to take care of their children and the elderly, feel more responsibility on their shoulders because they still need to work in farms as well. Moreover, the urban bias erases the mere possibilities of investing into more efficient techniques of production. There is a pressing need for a redistribution of (as well as markets for) agricultural products:

“Spread-out rural towns and secondary cities tend to be associated with far greater penetration of rural areas with adequate transport links and marketing arrangements than when urbanization has focused on mega-cities” (Cleaver, 1993, p. 89).

Thus, a strong and accountable state is necessary in order to prevent lobbying from urban elites and to develop a comprehensive approach that aims at finding a balance between rural

and urban areas in public investment, especially in infrastructures. This includes the promotion of small and medium industries (through credit and fiscal policies), public expenditure in secondary cities and well-distributed infrastructure investment. The result would be rapid agricultural growth, sustained by urban growth, which would create markets for agricultural products as well as providing enough supplies for farms' inputs. Thus, the international community should invest in strong and accountable governments, through loans that are connected to the condition of achieving the just mentioned goals through the right investments (Cleaver, 1993, p. 90). Even if urban bias were to be entirely eradicated, there is still the problem of getting farmers to produce more efficiently and to take risks such as using new fertilizers or enhanced seeds with which they might not be familiar. A farmer, who produces just above subsistence-level, has no incentive to take any risks of changing the way he produces, as this could lead to a food shortage for his own family. Thus, local governments need to create an enabling environment of predictability through ensuring contract enforcement which would lead to the consolidation of private investments into technologies and more efficient modes of productions. Besides, farmers need insurances for the cases of unpredictable crop losses caused by extreme weather (Smirzai, 2005, p. 272). Hence, a strong, effective and accountable state is not only necessary for an environment of predictability, but also in order to prevent warlordism and the exploitation of natural resources by foreign companies. It can be very unfortunate for the development if foreign companies establish corruption-alliances with local governments, as has happened, for instances, in the Democratic Republic of Congo, Sierra Leone, or in Nigeria (Lezhnev, 2005, p. 17).

#### *3.4. How to achieve a shift in the manufacturing sector*

As already exemplified, the development and improvement of the manufacturing sector depends on the development of agricultural sector. The more the sector grows productively,



the more labour and raw materials can go to the manufacturing sector. In order to be able to absorb the large influx, improved human skills as well as the capacity to exploit advanced technologies are necessary for a shift to producing more skills- and capital-intensive products:

“This submits to the SSA countries a compound challenge- to assimilate and adapt the well-tried technologies required to diversify their productive structure while upgrading their ability to benefit from emerging technologies, and thus be able to compete in international markets” (UNIDO, 2004, p. 109).

The purchase of advanced technologies and higher education on a large scale could be financed through external loans or aids. To be able to use advanced technologies, it is necessary to build capabilities and networks among public institutions (e.g. universities), industry support organizations, and banks. Ideally, a close institutional cooperation would lead to a higher number of skilled workers, fair credit-awarding systems and investment from industry support organizations for specific projects (UNIDO, 2004, p. 52). For the achievement of these goals, many actors; such as independent credit-institutes, foreign companies and states that provide new technologies and national governments are important to create the mentioned environment of predictability. It should be noted that in the three parts of the structural transformation, the ultimate goal is self-sustainability for SSA; i.e. to be able to develop independently.

#### **4. Effects of pollution, environmentally harmful practises and global warming on Sub-Saharan Africa**

In this section, the direct link between global warming, pollution and underdevelopment in SSA is stressed in order to emphasize on the importance of eco-friendly development measures. There is a direct link between global warming and economic efficiency

(Thornton et al., 2008). Most economic activities in SSA are based on its natural resource-endowments. As already mentioned, the region is heavily reliant on the export of primary goods. Although the need to carry out structural adjustments policies in order to change the reliance on the export of volatile goods is increasingly understood, the adjustments remain as a time consuming and long-run process. The agricultural sector is important in the early stages of development as a source of: food, industrial labour, domestic savings, market for industrial products, and foreign currency for agricultural exports (Smirzai, 2005, p. 274). Thus, stagnation in the primary sector will halt the development of manufacturing industries. While sustainable development needs to be achieved through economic growth, social justice and environmental integrity (Saundry, 2008), to maximize the outputs, much pressure is put on natural resources with little attention to sustainability. Fertilizers and pesticides often contaminate drinking water, which significantly endangers human and environmental health in some regions while the demand for water is arising in agricultural sector and mining (mining is done through the clearing of vegetative cover in sensitive water catchment areas and forests). In case of further agricultural growth, social conflicts and poverty seem probable. When farmers in SSA attempt to get access to more land for cultivation, deforestation (the clearing of forests through fire) is widely practised. The Ivory Coast and Nigeria each accounts for about 5-6% of the 20% of global warming that can be attributed to deforestation (Glantz, 1992, p. 6). Many areas of the continent are already subjected to recurring droughts as a consequence of the increasing average in global temperature. According to UNEP (2002, p. 51), SSA is the most vulnerable area to climate change due to its propensity for drought and desertification, its dependency on subsistence agriculture, and its vulnerability to poor rainfall. The limited economic resources which would serve to mitigate the consequences of the increased frequency and intensity of natural disasters, cause a situation in which even a slight change in climate can

be a big disaster in the region (UNEP, 2002, p. 50). Horrifyingly, the most recent report by Nelson at IFPRI, predicts that a loss in the average of wheat yields up to 22 percent by 2050, as a result of climate change in SSA, since the region it will be too hot to grow certain crops like wheat (Walsh, 2009). In tropical and subtropical regions, such as Central, Western and Southern Africa, where some crops grow near their maximum temperature tolerance and where drylands and non-irrigated agriculture are dominated, yields are likely to decline due to even small climate changes (Beg et al., 2002, p. 4). Further, Nelson states that irrigation water supply will decrease and, subsequently, food availability will lessen an average of 500 calories per person per day. Further, the majority of the population in SSA live in rural areas where income and employment depend almost entirely on rain-fed agriculture. According to the United Nations Environment Programme, due to global warming, the region is being faced with:

“...warming between 0.2°C and 0.5°C per decade, with 10% less rainfall in interior regions under intermediate global warming scenarios, and water losses increased by rising temperatures...Climate-induced changes to crop yields and ecosystem boundaries will dramatically affect some of the poorest people in sub-Saharan Africa partly because many of them live in areas most prone to extreme climate events and partly because they have little capacity to adapt by turning to irrigated agriculture, improved seeds or alternative livelihoods“ (UNEP, 2002, p. 62).

It has been predicted that an overall loss in agricultural production can be expected during the next century (Beg et al., 2002, p. 4-5). As stated in “Climate Policy review”:

“Beyond the direct economic impacts, crop failure due to climate change could also increase unemployment, destabilise food security, further increase competition for scarce resources, and increase social inequity” (Beg et al., 2002, p. 133).

457

458 Furthermore, global warming will increase evapotranspiration rates which could create  
459 moisture stress in certain plants, necessitating a need for supplemental water supplies in  
460 response to decreases in soil moisture. It should be noted however, that droughts and the  
461 rising temperature do not cause underdevelopment per se. Droughts are more likely to cause  
462 famines in case that the state is shaken by internal conflict or civil wars and, accordingly does  
463 not have the capacities to adjust its structure in order to deal with the effects of the heat  
464 (Glantz, 1992, p. 2). Another consequence of global warming is the rise of the sea level,  
465 which could pose a threat to Sub-Saharan Africa's Coastal regions. If, for instance, the sea  
466 level were to rise one metre in the near future, African river deltas would be at great  
467 risk of inundation. Thus in the future, the region could be shaken not only by long-lasting  
468 droughts that lessen agricultural productions and lead to water shortages, but also by floods  
469 that demolish agricultural crops. More specifically, Central Africa will be facing increased  
470 precipitation, soil moisture and run-off that will change flooding patterns, increase the  
471 contamination risk of freshwater supplies and encourage outbreaks of water-borne diseases.  
472 Malaria will thus be spread to higher altitudes, while it was previously limited to lower  
473 altitudes due to low temperatures and less rain in the mountains (UNEP, 2002, p. 46). The  
474 increased rainfall has shown to often have a negative impact on the likelihood of social  
475 conflicts (Hendrix and Glaser, 2007, p. 4). As explained earlier, internal conflicts are part of  
476 the reason for SSA's underdevelopment. Accordingly, climate change will be an impediment  
477 to achieve development goals like combating poverty, food security, enabling access to basic  
478 services such as clean water, sanitary living conditions, energy, and education.  
479 Additionally, a new environmental problem is emerging in SSA, namely ambient air pollution  
480 in urban centres, especially in South Africa. The increasing levels of toxic pollutants pose a  
481 threat to human health and atmosphere (UNEP, 2002, p. 51). This is due to population growth

and urbanization that put pressure on transport systems and lead to the increased vehicle emission, especially because most vehicles are old and thus have a high level of toxic emissions (Abam and Unachukwu, 2009, p. 551). Another reason for the newly emerged problems is the high emission of burning coal, wood and other fuels in order to meet domestic energy requirements (UNEP, 2002, p. 29-30). Although it is now clear that environmental protection is vital for socio-economic development, it should be noted that, in the discussion of environmental measures in SSA, a distinction needs to be made between the measures against global warming in general and those against the local environmental problems. The latter include environmentally harmful practices in farming and mining and their consequences. Thus, a dual approach to improve the environment is necessary. In conclusion, SSA is, in comparison, extensively affected by the increase in global temperature due to many different factors. Especially, because the income levels are low and the population relies on agricultural outputs which are volatile and sensitive to changes in climate and rainfall. Thus, effects that the change and the careless treatments of the environment have in SSA are with no doubt not only harmful to economic growth but also to the region and its people in general and could lead to devastating consequences for the whole continent. For example, the Horn of Africa is historically faced with chronic and currently acute droughts which together with inappropriate policies of land tenure systems (Azadi et al., 2011b) have caused a significant loss in agricultural productions resulted in a widespread famine (Bazuin et al., 2011). Furthermore, climate change and agricultural downturn in the region have forced the population (most importantly pastoralists) to move and cause conflicts over land territory (Barrios et al., 2006). Another example, according to Abdalla (2006) is in Sudan where the dried wells are a part of the Darfur crisis. Some links between climate change and human health are more complex. For instance, the predicted drought in SSA could increase the

incidence of HIV infection, as poor rural farming families move to cities where conditions foster unsafe prostitution jobs (McMichael et al., 2008).

## **5. What environmental measures can be taken alongside socio-economic development measures?**

The next question after stressing on the role of environmental issues in SSA would be “what can be done in order to improve environmental conditions?” To answer, we will discuss the compatibility and incompatibility of the environmental issues with the development measures. In SSA’s predominantly rural economies, solving environmental problems and changing harmful practices means to ensure better living conditions for the millions. According to Bertinelli et al., (2005) (contrary to the general academic opinion and especially the EKC):

“... reduction in pollution may feasibly happen at a very early stage of economic development”(Bertinelli, 2005, p. 4).

However, rising per capita income will not in itself ensure improvements in environmental performance. The mentioned practices of deforestation and overexploitation of natural resources need to be stopped urgently while farmers are increasingly maximizing their profits by using all the natural endowments they have. Thus, some urgent interventions to change such destructive behaviours need to be launched. For example, an incentive on the award of tangible aid in the form of technologies or training could be offered. Also, the agricultural insurance should be launched and extended. Furthermore, subsidies should be given to promote technological improvements that care about global warming as well as local environmental degradation threats. Surely, such interventions asks for huge money

(Ekins, 2000), however, we should not be forget that the costs are still lower than large waves of refugees which can pose due to our careless attention to SSA's natural resources.

#### *5.1. Role of technology adoption in environmentally friendly development measures*

Many environmental problems of the region, especially those related to pollution are connected to the age of technologies in use:

“Reduction in environmental pollution during the industrialization process is only possible when the optimal rate of technological adoption has been reached” (Bertinelli et al., 2005, p. 8)

According to their reasoning, traditional theories about the relationship between pollution and socio-economic development, such as the Environmental Kuznets Curve by Grossman and Kruger (1991), which conclude that underdeveloped regions cannot go for environmentally friendly approaches, disregard the importance of the replacements of old technologies. Hence, if technologies are replaced at the right time, a country, which is still on the path of early industrialization, can be industrialized in an efficient as well as eco-friendly way. Up until the attainment of the scrapping age, the output-pollution-ratio will be increasing. However, thereafter, the ratio might be declined, depending on “... the countries investment rates and willingness to improve technologies in terms of environmental friendliness” (Bertinelli et al., 2005 p. 18). Yet, the question is whether it would be possible to support developing countries in “... leapfrogging the adoption of older technologies in order to fasten the pace towards cleaner development?” (Bertinelli et al., 2005, p. 19).

Due to the urgency of increasing the environmental standards, this should definitely be possible. Most African states do not have enough savings in order to buy more efficient

and eco-friendlier technologies. If loans were connected to the condition that efficient and eco-friendly technologies would be bought by, it would be an investment into the fixed costs of production, which would enable economies of scaling and therewith profiting investors and, furthermore, improve environmental conditions.

“... much of the technology imported into developing countries is through second hand machinery...the technologies embedded in imported second hand machinery, however, tend to be much older than the state of the art and often have a dubious environmental record...it has been estimated that the export of second-hand cars to developing countries and emerging markets world-wider...will create additional pollution of 1,8 million tonnes of carbon dioxide” (Bertinelli et al., 2005, p. 18).

Thus, if developed countries could stop exporting their old technologies to developing countries and provided new but moderate prices technologies along with training how to use them, such aids would influence global warming. Therefore, making profit through selling old technologies should be forbidden. Providing new technologies at a moderate price from abroad should only be a temporary solution since SSA needs to have enough purchasing power to afford such technologies. Accordingly, the ‘countries investment rate’ should be determined by foreign direct investors. Also, bonuses (e.g. at the EU level) should be prioritized for environmental-friendly techniques and innovations. If a high standard of environmental protection is introduced right at the beginning of development strategies, a negative link between industrialization and pollution and subsequent stagnation of development will be prevented. In the course of development, sectorally and regionally focused technology upgrading programs need to address more serious environmental pollution problems in order to give SSA a chance of developing in a sustainable manner. In addition, SSA needs support in recognizing the “scrapping age” of



technologies and introduction of eco-friendly technologies. With newer technologies, productivity should be enhanced in the utilization of energy, water and material sources. Sources such as solar energy, are often cheaper in the long run and also make the region less dependent on the external energy resources.

## *5.2. Necessity of developing in an environmentally friendly manner; institutional arrangements for development*

As noted, in the African environmental outlook, there is a pressing need for radical changes in technology "...if economic development is to proceed without adding to the existing environmental challenges" (UNEP, 2002, p. 51). The so far economic developments are mostly achieved by the measures that disregard environmental aspects. Besides, replacing technologies in the process of industrialization in order to diminish global warming, the Sub-Saharan African countries need to invest also in disaster preparedness. Some environmental measures have already been successfully implemented in SSA by local governments such as, the expansion of electrification programmes, promotion of unleaded, and conversion to cleaner fuels (UNEP, 2002, p. 392). Moreover, the poorer and landlocked countries in SSA will need considerable foreign supports in the immediate preparation of disaster preparedness. Fundamental changes will still have to be made in the energy and manufacturing industries as well as in transport systems in order to supply sustainable energy, material and mobility to the future generations. Moreover, in the context of global warming, it is important that all stakeholders (Azadi et al., 2011d) and sectors of the economy mutually coordinate their actions. In Kenya, for instance, in order to ensure cooperation, a National Climate Change Activities Coordinating Committee that includes members from ministries of agriculture, forestry, energy, planning, finance and industry, research institutes, municipal councils, public universities, the private sectors and

NGOs has been established. The committee coordinates and facilitates research, response strategies, policy options, and public information and awareness (UNEP, 2002, p. 38). Similar institutions can be found in most states of SSA, thus, a willingness to tackle the problems and a general recognition of the need to coordinate are already being recognized. Furthermore, environmental impact assessments should be made obligatory (like in the EU, European Commission, 2009) for any new industrial or agricultural practice that could eventually threaten the environment. It should, furthermore, also not be forgotten that Central Africa's extensive tropical forests are carbon sinks and are very important and effective in the process of mitigating green house gas emission. Thus, it is highly important, not only because of the previously mentioned local negative effects of deforestation but also in the global context, to establish a legal regime that protects those large forest areas. Accordingly, environmental measures as the development improvements strategies appear to be little puzzle-pieces which complete each other in constituting the "big picture" of development. The theory of "development now, environment later" (UNIDO, 2004) or "pollute first, clean up later" (Azadi et al., 2011c) is supported by the fact that, most indicators show that environmental degradation first increases with growing income and starts to decline after a turning point. Like the EKC curve, this theory suggests to first wait for economic growth and general socio-economic development and wait until a region has become rich and educated enough to be able to make the necessary adjustments in the environment. It suggests that, otherwise, a country will not be able to compete in the international market, as industrialization will always be slowed down as soon as environmental effects are taken into account. In other words, a considerable increase in per capita income levels is seen as a prerequisite for the environmental improvements as well. However, critiques believe that there might not be enough time to "wait" for reaching high economic growth due to the rapid speed at which the climate is changing. Bertinelli et al.

(2005) discuss that it is not the only possible way of development although they do not present any evidence for the existence of the ECK. On the contrary, Azadi et al. (2011c) present the case of Brazil, India, and China as successful evidence of the theory and with some considerations, conclude that the “pollute first, clean up later” might still be feasible for some developing countries.

Global warming, on the other hand, can only to a small part be attributed to SSA, as the majority of global pollution has been caused by the industrialized nations (Norton, 2009). Therefore, it is questionable why the region should make an effort to fight a global problem of which it is the main victim, but which was mostly caused by the industrialized nations. Those states have, in comparison, gained large wealth through environmentally harmful practices and can now afford to take care of the environment. However, as explained, SSA has no choice but to do everything that is possible in order to diminish the devastating effects of global warming on its development. Moreover, industrializing in an environmentally friendly way right from an early stage of development will have positive long-term effects on the region. Nevertheless, as SSA’s contribution to climate change has been little (Glantz, 1992, p. 5) the described environmental measures (which are quite often costly and time-consuming and especially call for large investments into fixed costs) as an integral part of a development strategy should, for the most part, be financed by industrialized states. Indeed, the industrialized states are already legally obliged to help less developed countries to work against climate change, through the Bali Action Plan and the Kyoto protocol, according to which developed countries have the primary responsibility of fighting global warming. Ideally, a legally binding agreement could be reached, committing all countries in the world to the fight against climate change and, moreover, establishing a global climate-fund, in which large and wealthy countries invest for the benefit of developing countries. Such a fund would be regarded as a global investment into

the well being of the planet. Hence, it is by no means inevitable that SSA's development will stagnate due to a lack of development aid and diminishing amounts of money available for investment into development in favour of environment and attempts to tackle global warming. Money made available for the fight against global warming should not be distracted from development aid funds. Foreign finances should be taken from an international fund to which states contribute according to their size and pollution-levels instead of diminishing development-aid in favour of environment. On the other hand, local measures, for example, deforestation and cultivation, lie in the responsibility of the region itself, while certain ethics (such as not to dump old technologies and apply environmentally-friendly investments) should not be disregarded.

### *5.3. Environmental education and the need for attitudinal change of policy makers*

Additionally, the main focus of environmental education programs should be to change environmental behaviour, through increasing environmental knowledge (Pooley and O'Connor, 2000). The main goal of such programs should be to create pro-environmental behaviour (Magnus et al., 1997), especially in the mind-set of policy makers (Hungerford & Volk, 1990). The programs should aim to offer long term solutions to environmental problems (Evans et al., 1996) of SSA and the main attention should be given how to change the values and analytical skills of the policy makers both in SSA and the industrialized nations (Bradley et al., 1997) to realize and accept the main causes of climate change when it comes to understanding the contributions of different nations to the climate change. Without a correct make up in the policy makers' mind, it would not be possible to make significant change in the environmental issues of SSA. At present, most environmental programs have paid little attention to the importance of changing the mind-set of 'policy makers' while they have

mostly focused on understanding and changing the perceptions of pastoralists (Ho and Azadi, 2010) or farmers (Zhao et al., 2011).

## **6. Conclusion**

### *6.1. Summary*

The field of analysis in this paper might have been a bit too wide, as a very large region was treated. This simplification, however, was made because global warming has large effects on a very wide area of land and people. Focussing on a single state would have narrowed the analysis though the local measures were also taken into account. This analysis mostly focussed on the internal changes that should be made regarding the development and how the changes can be combined with the general objective of reducing global warming and protecting the environment. However, it should not be forgotten that SSA is also retarded in its development due to the international trade factors. These are, for instance, deteriorating terms of trade, a large debt problem, fluctuating exchange rates, the failure to produce in a way that is capable to compete with other regions and a possible structure of dependency. Thus, as soon as one focuses on the international market, there are a lot more barriers to SSA's development than described in this paper.

### *6.2. Conclusion*

The simple answer to the question whether socio-economic development and environmental improvement are reconcilable in SSA where the region is reliant heavily on agriculture, might not be possible as it may outweighs all other arguments like postponing the environmental measures. The consequences of only small rises in temperature in SSA could lead to the deprivation of millions of people and the destruction of the largest sector of the economy in SSA. Such consequences would make the development impossible at once, thus, arguments in

favour of “development first, environment later” should be cautioned since any underestimate on the environmental impacts might create a large obstacle to sustainable development of the region. Hence, environmental and developmental measures should be mutually regarded. As discussed by Bertinelli et al., (2009), there is a way to industrialize the region in an environmentally compatible way. Even though bringing the development measures to the environmental standards might be more expensive and time consuming due to investments in new industries, technologies or energy sector, it will be more beneficial in the long run. In this respect, international aids are required to give SSA an initial push towards “greener” development pathways. The environmental measures need to be an inherent part of current development strategies and should not be regarded as a separate issue. Furthermore, the region might not have time to “wait” for its own socio-economic development in order to accumulate money to face the challenges of droughts, floods, connected diseases and rise of poverty. As already exemplified, especially in tropical and subtropical regions in Central, Western and Southern Africa, some crops exist near their maximum temperature tolerance and, hence, already a small change in climate can have negative consequences in the sense that yield-production will diminish considerably, depriving many small peasants of their income and therewith making poor people poorer. Accordingly, there is no time to focus on development first in order to make the region less vulnerable and more innovative. Rather, environmental and socio-economic development must go “hand in hand”. If environmental policy interventions play a role in earlier stages of development, it allows the Sub-Saharan African countries to prevent an early harmful link between industrialization and pollution, which in other states has caused global warming in the first place. However, to launch such green pathways, the policy makers in industrialized nations need to realize that global warming as well as regional environmental degradation are global problems, which will affect everyone eventually. The policy makers should change their attitudes and acknowledge their

responsibility for the people suffering from global warming in SSA. This is an important starting point of achieving socio-economic and environmental development in the frame of green pathways in the region. Moreover, SSA is the region that contributed the least to but suffering the most from global warming. One does not need to be convinced of the dependency-theory in order to recognize the responsibility of industrialized and developed nations in this respect. To assist SSA with developing in the most environmentally friendly way, it must be seen as a global responsibility. If this necessity and responsibility are well-understood and accepted by state-officials of all industrialized countries, every state should contribute to an international fund to make the reconcilability possible.

### *6.3. Recommendations*

In describing specific cases, the conclusion might then be reached that the region does have to accumulate some wealth before it has the capacity to address certain environmental issues. Furthermore, the described way of financing anti-climate change policies that was described is not only hypothetical and an ideal imagination, but also a topic to be further analyzed in the future studies of international laws. Only in the frame of such global acts, the responsibility of industrialized and developed countries with regard to climate change can be legalized and proceedable. Furthermore, the shift to produce more capital-and skills-intensive activities should empirically be tested in a couple of SSA's nations to have some evidence regarding the possibility of this strategy at hand. Thus, development studies need to address more than one state, and regional integration needs to be investigated as a key factor in these studies. Lastly, the problem of accountability of the Sub-Saharan African nations and the difficulties in monitoring whether or not foreign aids are used correctly by them should be the other important issues to be addressed in the future studies.

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